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UNITED STATES INTELLIGENCE BOARD

USIB-D-27.8/5
8 March 1976

MEMORANDUM FOR THE UNITED STATES INTELLIGENCE BOARD

SUBJECT : Implementation of the Metric System of Units in Intelligence Community Reporting

REFERENCE : USIB-D-27.8/2, 25 February 1974, and Memorandum for Holders thereto, 14 March 1974

1. The enclosed memorandum on the subject from the Chairman, of the USIB Metric Panel and its attachment are circulated for Board consideration of the Panel's recommendations in [redacted] memorandum, particularly the recommendation in paragraph one that the plan as set forth in reference a. should now be implemented. Because certain significant events have occurred since the plan was approved two years ago, [redacted] recommends modifications to the proposed schedule presented in the report as outlined in paragraphs two and three of his memorandum.

USIB ACTION REQUESTED

2. Board members are requested to advise the Secretariat by close of business 18 March of their concurrence or comments on the proposals contained in the attached memorandum from the Metric Panel.

[redacted]
Executive Secretary

Enclosure

Enclosure
USIB-D-27.8/5
8 March 1976

MEMORANDUM FOR USIB PRINCIPALS

SUBJECT: Implementation of the Metric System of Units in Intelligence Community Reporting

REFERENCES:
a. Report of the USIB Metric Panel, February 1974
b. World Weights and Measures (Handbook for Statisticians) UN Department of Economic & Social Affairs ST/STAT/SER. M1211 Rev. 1, 66.XVII.3

1. On 23 December 1975 the President signed into law the metric conversion act which commits the United States "to coordinate and plan the increased use of the metric system in the United States." Accordingly the plan set forth in the report of the Metric Panel dated February 1974 should now be implemented. Because certain significant events have occurred in the intervening two years, modifications to the proposed schedule presented in the report are recommended.

2. According to reference a., which was noted by USIB, the two month period following the enactment of the conversion legislation will be used for basic familiarization and training by each major component of the Intelligence Community. Because of unforeseen problems, the Metric Panel recognizes that the familiarization and training phase may not have been completed by late February as recommended in the reference. We now recommend that this phase be completed at least by mid-May 1976. The Metric Panel reaffirms that 18 months (beginning in mid-May 1976) be the maximum period for use of dual units for Intelligence Community reporting. After that, reporting will be in the metric units (SI) only. We recognize that some components (especially parts of DoD) have taken signif-

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icant action already and are "ahead of the game."

3. As stated in reference a, the Intelligence Community will make a number of exceptions to the pure SI units. The Metric Panel now proposes that the exceptions should be those in the Federal Register of 19 June 1975 which includes the item on "Metric System of Units," a copy of which is attached. The Metric Panel recommends there be at least three additional exceptions. The first two are the continued use of the terms barrels (and barrels/day) and bushels as used by the economic community. Also the nuclear intelligence community should continue to use tons in its reporting rather than the SI term joules. The use of kilograms or metric tons rather than newtons as the unit of thrust is under consideration by the Weapons & Space Systems Intelligence Committee. Additional exceptions may be recommended by the Metric Panel upon request of any IC component.

4. Some raw reporting in the Intelligence Community uses units which are neither SI nor customary. It is proposed that such units be converted directly into SI units as recommended in the United Nations document entitled "World Weights and Measures (Handbook for Statisticians)" (Reference b).

[redacted]
Chairman
Metric Panel

Attachment:
a/s

federal register

THURSDAY, JUNE 19, 1975
WASHINGTON, D.C.
Volume 40 ■ Number 119
Pages 25799–26012
PART I

HIGHLIGHT OF THIS ISSUE

National Bureau of Standards

METRIC SYSTEM OF WEIGHTS AND MEASURES

Guidelines for Use

Section 403 of Pub. L. 93–380 states the policy of the United States to encourage educational agencies and institutions to prepare students to use the metric system of measurement as part of the regular education program and authorizes the U.S. Commissioner of Education to carry out a program of grants and contracts to fulfill this policy. Subsection 403 (a)(3) states, "For the purposes of this section, the term 'metric system of measurement' means the International System of Units as established by the General Conference of Weights and Measures in 1960 and interpreted or modified for the United States by the Secretary of Commerce." The National Bureau of Standards is responsible for "the custody, maintenance, and development of the national standards of measurement" (15 U.S.C. 272), and the Secretary has designated NBS to implement his responsibilities under subsection 403(a)(3). Pursuant to his authority under section 403, the U.S. Commissioner of Education has requested that NBS publish guidelines for use of the International System of Units, as interpreted and modified for the United States. Accordingly, and in implementation of the Secretary's responsibilities under subsection 403(a)(3), the following tables and associated materials set forth guidelines for use of the International System of Units (hereinafter "SI"), as interpreted and modified for the United States by NBS on behalf of the Secretary of Commerce.

The SI is constructed from seven base units for independent quantities plus two supplementary units for plane angle and solid angle, listed in Table 1.

TABLE 1

Quantity	Name	Symbol
SI BASE UNITS		
length	metre (meter)[1]	m
mass[2]	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature,[3]	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd
SI SUPPLEMENTARY UNITS		
plane angle	radian	rad
solid angle	steradian	sr

[1] Both spellings are acceptable.
[2] "Weight" is the commonly used term for "mass."
[3] It is acceptable to use the Celsius temperature (symbol t) defined by $t = T - T_0$ where T is the thermodynamic temperature, expressed in kelvins, and $T_0 = 273.15$ K by definition. The unit "degree Celsius" is thus equal to the unit "kelvin" when used as an interval or difference of temperature. Celsius temperature is expressed in degrees Celsius (symbol °C).

Units for all other quantities are derived from these nine units. In Table 2 are listed 17 SI derived units with special names which were derived from the base and supplementary units in a coherent manner, which means in brief, that they are expressed as products and ratios of the nine base and supplementary units without numerical factors.

TABLE 2.—*SI derived units with special names*

Quantity	SI unit: Name	Symbol	Expression in terms of other units
frequency	hertz	Hz	s^{-1}
force	newton	N	$m \cdot kg/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, quantity of heat	joule	J	$N \cdot m$
power, radiant flux	watt	W	J/s
quantity of electricity, electric charge	coulomb	C	A·s
electric potential, potential difference, electromotive force	volt	V	W/A
capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
conductance	siemens	S	A/V
magnetic flux	weber	Wb	V·s
magnetic flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
luminous flux	lumen	lm	cd·sr
illuminance	lux	lx	lm/m^2
activity (radioactive)	becquerel	Bq	s^{-1}
absorbed dose	gray	Gy	J/kg

All other SI derived units, such as those in tables 3 and 4, are similarly derived in a coherent manner from the 26 base, supplementary, and special-name SI units.

TABLE 3.—*Examples of SI derived units, expressed in terms of base units*

Quantity	SI unit	Unit symbol
area	square metre	m^2
volume	cubic metre	m^3
speed, velocity	metre per second	m/s
acceleration	metre per second squared	m/s^2
wave number	1 per metre	m^{-1}
density, mass density	kilogram per cubic metre	kg/m^3
current density	ampere per square metre	A/m^2
magnetic field strength	ampere per metre	A/m
concentration (of amount of substance)	mole per cubic metre	mol/m^3
specific volume	cubic metre per kilogram	m^3/kg
luminance	candela per square metre	cd/m^2

TABLE 4.—*Examples of SI derived units expressed by means of special names*

Quantity	Name	Unit symbol
dynamic viscosity	pascal second	Pa·s
moment of force	metre newton	N·m
surface tension	newton per metre	N/m
heat flux density, irradiance	watt per square metre	W/m^2
heat capacity, entropy	joule per kelvin	J/K
specific heat capacity, specific entropy	joule per kilogram kelvin	J/(kg·K)
specific energy	joule per kilogram	J/kg
thermal conductivity	watt per metre kelvin	W/(m·K)
energy density	joule per cubic metre	J/m^3
electric field strength	volt per metre	V/m
electric charge density	coulomb per cubic metre	C/m^3
electric flux density	coulomb per square metre	C/m^2
permittivity	farad per metre	F/m
permeability	henry per metre	H/m
molar energy	joule per mole	J/mol
molar entropy, molar heat capacity	joule per mole kelvin	J/(mol·K)

For use with the SI units there is a set of 16 prefixes (see table 5) to form multiples and submultiples of these units.

TABLE 5.—*SI prefixes*

Factor	Prefix	Symbol
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Certain units which are not part of the SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use in the United States with the International System are listed in table 6.

TABLE 6. *Units in use with the international system*

Name	Symbol	Value in SI unit
minute	min	1 min = 60 s
hour	h	1 h = 60 min = 3 600 s
day	d	1 d = 24 h = 86 400 s
degree	°	1° = (π/180) rad
minute	′	1′ = (1/60)° = (π/10 800) rad
second	″	1″ = (1/60)′ = (π/648 000) rad
litre (liter)[1]	l	1 l = 1 dm^3 = 10^{-3} m^3
metric ton or tonne	t	1 t = 10 kg

[1] Both spellings are acceptable.

In those cases where their usage is already well established, the use, for a limited time, of the following units is accepted, subject to future review.

nautical mile	hectare	gal[1]
knot	bare	curie
angstrom	bar	roentgen
standard atmosphere	are	rad

[1] Not gallon.

Metric units and their symbols other than those enumerated above are not part of the International System of Units. Accordingly, the following units and terms listed in the table of metric units in section 2 of the act of July 28, 1866, that legalized the metric system of weights and measures in the United States, are no longer accepted for use in the United States:

myriameter
stere
millier or tonneau
quintal
myriagram
kilo (for kilogram)

For more information regarding the International System of Units, contact the Metric Information Office, National Bureau of Standards, U.S. Department of Commerce, Washington, D.C. 20234.

Dated: June 1, 1975.

RICHARD W. ROBERTS,
Director.

[FR Doc.75-15798 Filed 6-18-75;8:45 am]

Note: The kilogram is the only SI unit with a prefix. Because double prefixes are not to be used, the prefixes of Table 5, in the case of mass, are to be used with gram and not with kilogram.